



FOREST PEST MANAGEMENT

EVALUATION OF BALSAM WOOLLY APHID ADELGES
PICEAE (RATZ.) IN THE CLINGMAN'S DOME AREA
OF THE GREAT SMOKY MOUNTAINS NATIONAL PARK N.C.

By

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INTRODUCTION

The balsam woolly aphid Adelges piceae (Ratz.) was accidentally brought to the United States from Europe in the early 1900's. It attacks most true firs causing the death and/or disfigurement to its host. Fraser fir, Abies fraseri (Pursh.) Poir.), which is a principal component of the spruce fir type of the Great Smoky Mountains National Park is particularly susceptible and usually dies within 2-6 years after attack. There is less than 60,000 acres of this tree species in the world with 38,000 acres of this species occurring in the Great Smoky Mountains National Park. A current summary of information on the balsam woolly aphid in the Southern Appalachians is contained in a report sponsored by the Southern Appalachian Research Resource Management Cooperative (Johnson, 1980).

Infestations of this pest began to appear in the Great Smoky Mountains National Park around 1963 and since that time have killed many thousands of trees. The aphid was discovered in the Clingman's Dome area in 1972. Currently, dead Fraser fir trees are a common sight along the scenic drive from Newfound Gap to Clingman's Dome.

The purpose of this evaluation was to determine the current status and potential of the balsam woolly aphid in the Clingman's Dome area of the Great Smoky Mountains National Park.

TECHNICAL INFORMATION

Insect - Balsam woolly aphid, Adelges piceae (Ratz.).

Hosts - Balsam woolly aphid was introduced from Europe around 1900. True firs are the only known hosts of the aphid. In the southeastern United States the bracted balsam fir (Abies balsamea var. phanerylepis (Fern.) and the Fraser fir (A. fraseri (Pursh.) Poir.) are the species affected.

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Type of Damage - "Gouting" appears as a stunting of terminal growth swellings around the buds and branch nodes. Trees with this type of injury decline slowly. Growth is retarded and the dead and dying upper stem is often invaded by wood-destroying fungi. Bracted firs are mostly attacked by gout infestations. Fraser fir is affected mostly by the more serious type of mass infestation along the stem. Stem attacked trees usually die within two to six years. The foliage on a dying tree turns yellow, then deep red or brown. While feeding, the aphid injects a substance into the bark that causes abnormal cell division. Obstruction of the water-conducting tissue seems to be the principal injury associated with stem infestations.

Life Cycle of the Aphid - The balsam woolly aphid reproduces by parthenogenesis as there are no males in North America. The adult female produces a wool-like material in which she lays amber-colored eggs. The eggs hatch into active crawlers which seek a place to feed and inserts its mouthparts. Once the mouthparts are inserted the aphid will not move again. It transforms without moulting into neosistens. Two generations and a partial third usually develop in North Carolina. Long range spread is accomplished mainly by wind.

METHODS

An aerial sketchmap survey was conducted by Forest Pest Management during June 1982 to locate dead and dying fir in the Clingman's Dome area of the Great Smoky Mountains National Park (Figure 1). Aerial photographs were taken to document the tree damage on Clingman's Dome and an intensive ground search was made to locate balsam woolly aphid infestations adjacent to the Clingman's Dome parking lots and trail. (Figures 2 & 3). One inch square bark samples were taken at breast height from 29 sampling points in the Clingman's Dome area. Samples were taken below the parking lot, between the parking lots, above the parking lots and along the trail to the Dome (Figure 2). Bark samples were examined using a microscope to determine the number of aphids per square inch.

RESULTS

The aerial survey showed patches of fir mortality throughout the spruce-fir type (Figure 4). Especially noticeable were dead trees along the scenic drive to Clingman's Dome from Newfound Gap and near the parking lot at the Dome.

Ground examination of the Fraser fir revealed heavy balsam woolly aphid infestation scattered throughout most of the area. Even in areas with no obvious aphid caused tree mortality, infestations were heavy. Samples taken from the bark showed heavy balsam woolly aphid infestations in the Clingman's Dome area (Table 1).

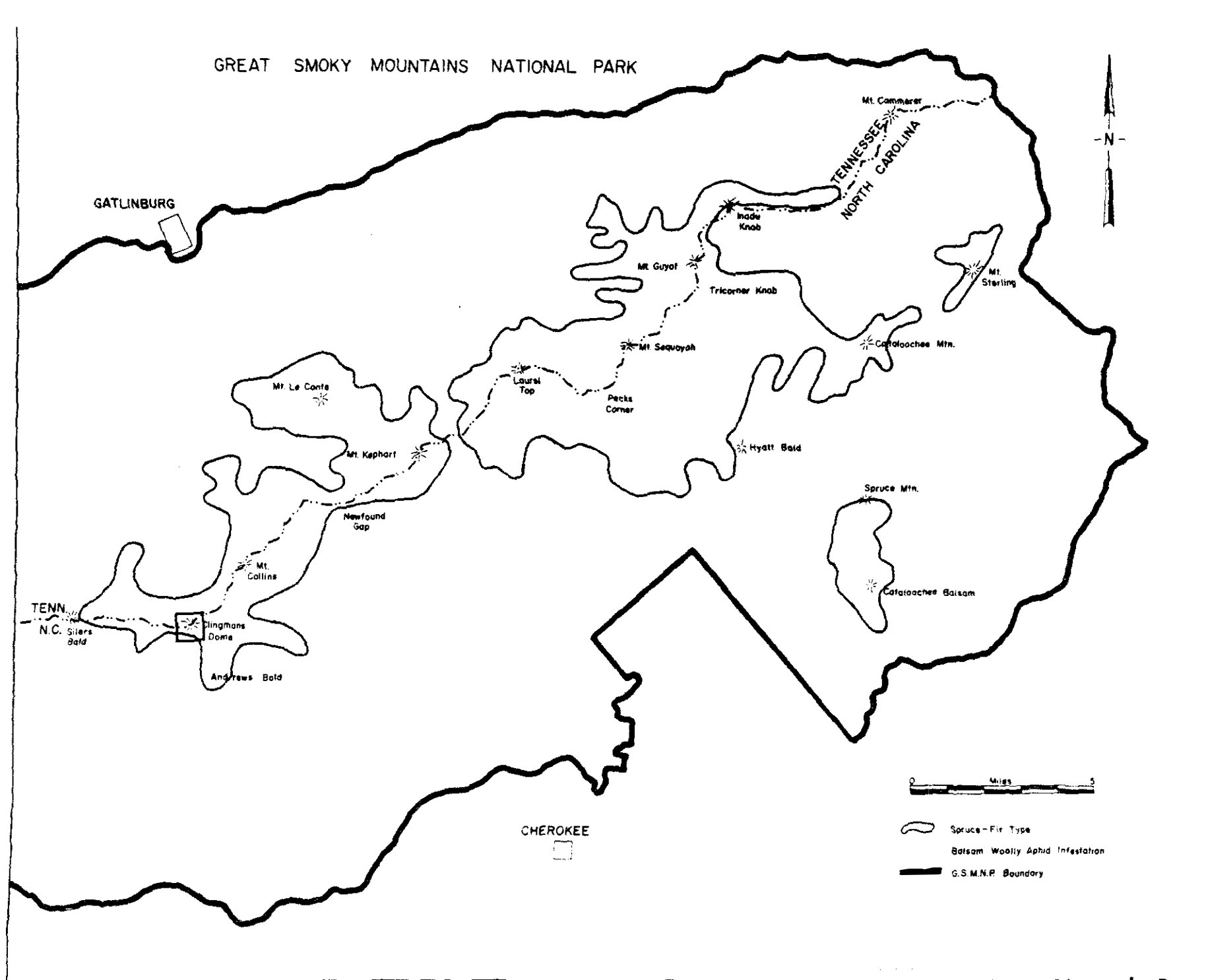


Figure 1 - Location of biological evaluation of balsam woolly aphid, *Adelges piceae* (Ratz.) at Clingman's Dome in the Great Smoky Mountains National Park.



Figure 2 - Vertical photograph showing location of area sampled for balsam woolly aphid infestations at Clingman's Dome, Great Smoky Mountains National Park, 1982.

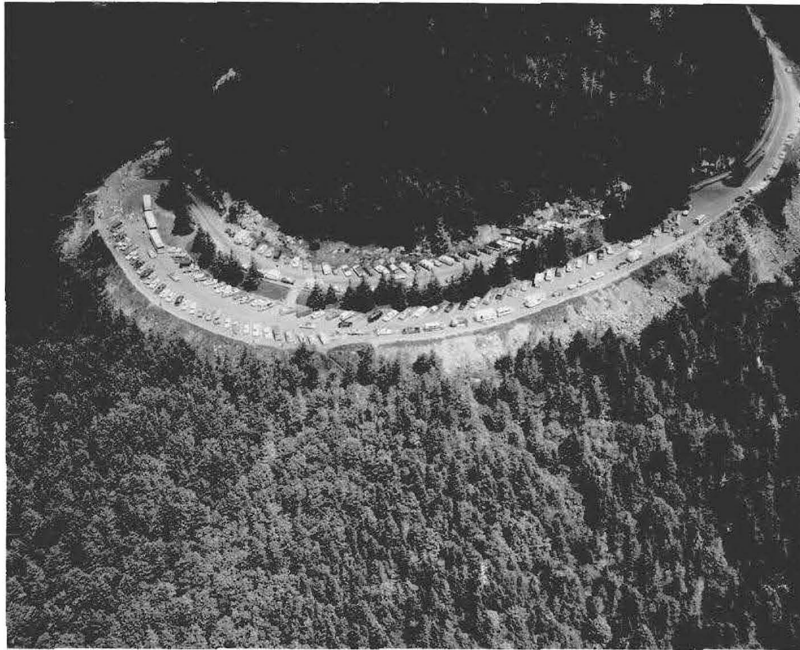


Figure 3 - Oblique view of area evaluated for balsam woolly aphid infestation around Clingman's Dome parking area, Great Smoky Mountains National Park.

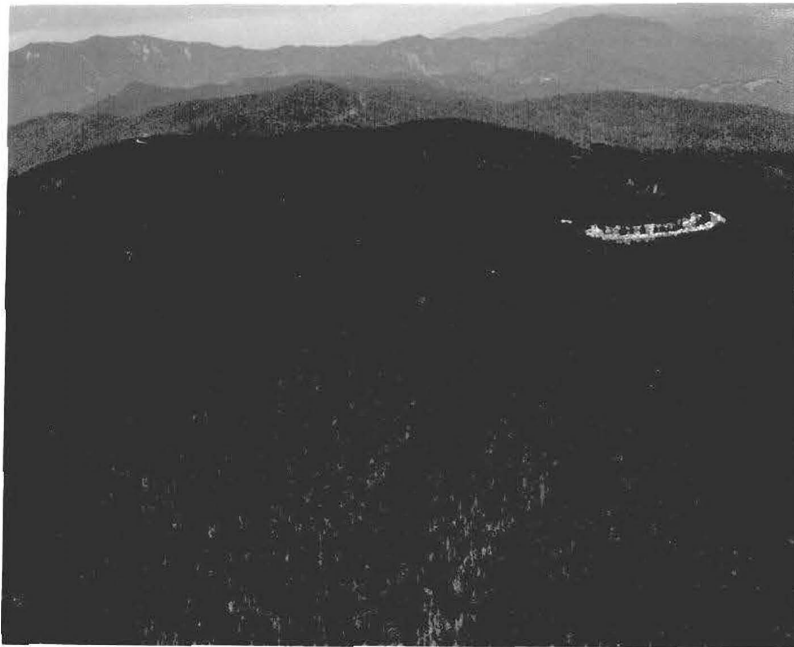


Figure 4 - Photograph showing heavy Fraser fir mortality occurring at lower elevation of Fraser fir type on Clingman's Dome Mountain, 1982.

Table 1. Number of Balsam Woolly Aphids Per Square Inch from Bark Samples in the Clingman's Dome Area of the Great Smoky Mountains National Park, July 8, 1982. 1/

Sample Location	Stage of Aphid				
	Eggs No. Sq. In.	Crawlers No. Sq. In.	Neosistens No. Sq. In.	Adults No. Sq. In.	All Stages No. Sq. In.
A (Below parking lot)	24	41	106	22	192
B (Trail to Dome)	20	18	29	5	72
C (Median)	41	14	144	12	210
D (Above parking lot)	3	.3	5	.5	8

1/ Trees were sampled at breast height and systematically selected in the Clingman's Dome area.

DISCUSSION AND CONCLUSION

Heavy infestations of balsam woolly aphid are present at Clingman's Dome and other areas of the Park. The infestations are spreading and are likely to infest all the fir in the Clingman's Dome area. Considerable tree mortality has occurred along the scenic highway from Newfound Gap to Clingman's Dome. Fir mortality is also occurring adjacent to the parking lots and between the parking lots. Unless some action is taken, tree mortality will continue at an increasing rate in this area.

Although the additional tree mortality is almost certain to occur, any decisions regarding suppression will depend entirely on the policies and management objectives of the Park. Currently there is not a practical method to eliminate this exotic pest from the Park. However, spraying of individual trees with hydraulic spray equipment from the ground has been effective in killing the aphids on infested trees and reducing tree mortality. This method is usually practical only on high value trees in areas such as recreation sites, scenic vistas, and along scenic highways and trails.

Currently insecticidal soap (fatty acid) is being tested by the Park in the Clingman's Dome area and at other locations by other agencies in the Southern Appalachians. Approximately nine acres were sprayed by the Park during the second week in July. Insecticidal soap has been found effective on the adult and crawler stages in Canada (Puritch, 1975), and is also expected to be effective in the Southern Appalachians. This material is considered safer than other insecticides recommended for balsam woolly aphid since it is a compound commonly found in plants and animals and is readily biodegradable. It also appears to have little effect on the natural enemies of the aphid and it is low in phytotoxicity. Forest Pest Management in cooperation with the Park Service will evaluate the effectiveness of this spray project.

RECOMMENDATIONS

Decisions regarding suppression will be made by the National Park Service. The following is a brief outline of possible alternatives considered by other land managers with varying management objectives. These alternatives will be discussed and evaluated by the Park.

Do nothing and let the aphid infestations run their course.

Cut the Fraser fir in the area and convert it to red spruce.

Cut only the infested Fraser fir.

Use insecticidal soap at the manufacturer's recommended rate to control the aphid in high value areas.

Use lindane at the 1/8 percent active ingredient to control aphid in high value areas (the chemical is on the restricted list of the agency and is not recommended in this area).

PESTICIDE PRECAUTIONARY STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key -- out of the reach of children and animals -- and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first-aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registration of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your county agricultural agent or State extension specialist to be sure intended use is still registered.

Before using any pesticide, read the label carefully.

REFERENCES CITED

- Johnson, Kristine. 1980. Fraser Fir and Balsam Woolly Aphid. The Southern Appalachian Research - Resource Management Cooperative. 62 p.
- Puritch, George S. 1975. The Toxic Effects of Fatty Acids and Thieir Salts on the Balsam Woolly Aphid, Adelges piceae (Ratz.). Dept. of Environment Canadian Forestry Serv., Pacific For. Res. Centre, Victoria, BC. Can. J. Forest Res. 5: 515-522.